NATIONAL PERFORMANCE AUDIT PROGRAM (NPAP)

THROUGH THE PROBE PERFORMANCE AUDITS
OF
AMBIENT AIR MONITORING STATIONS IN PUERTO RICO
OPERATED BY
PUERTO RICO ENVIRONMENTAL QUALITY BOARD
(PREQB)

JULY 12-14, 2016

CONDUCTED BY:

10/5/16
Avraham Teitz, Air and Water Quality Assurance Team

10/5/16
Mustafa A. Mustafa, Air and Water Quality Assurance Team

Monitoring and Assessment Branch
Division of Environmental Science and Assessment
U.S. Environmental Protection Agency - Region 2
2890 Woodbridge Avenue
Edison, NJ 08837

I. INTRODUCTION

During the period of July 12-14, 2016, US EPA Region 2 personnel conducted through the probe audits at the following Puerto Rico Environmental Quality Board (PREQB) air monitoring sites:

AIRS #720330004 - Cataño – Las Vegas (SO2)
AIRS #721230002 - Salinas (SO2)
AIRS #720330008 - Cataño Police Station (O3)
AIRS #720210010 - Bayamon Jail (NCore station)

II. OBJECTIVE

The purpose of this audit is to test and evaluate the performance of CO, SO2, O3, and NOx air monitoring analyzers operated by PREQB required by 40 CFR Part 58, Appendix A, Section 3.2.2. These audits are carried out by EPA Region 2 as part of the air monitoring National Performance Audit Program (NPAP), overseen and coordinated by the EPA Office of Air Quality, Planning, and Standards (OAQPS).

III. APPROACH

Performance of PREQB station analyzers is achieved by generating test atmospheres of CO, SO2, O3, and NOx using calibrated gas phase titration (GPT) calibrators, certified gas standards, and certified zero air supplies. Ozone concentrations are verified by a certified O3 analyzer that samples a portion of the test atmosphere provided to the station. The basic methodology used is outlined in the Standard Operating Procedures for the EPA Through-the-Probe National Performance Audit Program, 4/7/2011 edition. A summary of the procedure used for the PREQB audits is reproduced below:

A. Test atmospheres are introduced to the air monitoring station inlet probe.

B. Test atmosphere concentrations are verified by O3 analyzers or are generated by calibrated GPT devices that are part of the test apparatus.

C. Air monitoring station analyzer responses are recorded.

D. Air monitoring station responses are evaluated with respect to the expected values.

EPA acceptance criteria for ambient air audits are as follows:

Carbon Monoxide (CO)

Pass = Bias < ±15% OR difference from actual concentration < (0.03 ppm)

Fail = Bias > ±15% AND difference from actual concentration > (0.03 ppm)

Warning = Bias > ±10% AND difference from actual concentration > 0.030 ppm

Audit concentrations <0.200 ppm are not scored pass/fail, and are informational only

Sulfur Dioxide, and Oxides of Nitrogen (SO2, and NOx)

Pass = Bias < ±15% OR difference from actual concentration < 0.0015 ppm

Fail = Bias > ±15% AND difference from actual concentration > 0.0015 ppm

Warning = Bias > ±10% AND difference from actual concentration > 0.0015 ppm

Audit concentrations <0.005 ppm are not scored pass/fail, and are informational only

Ozone (O3)

Pass = Bias < ±10% OR difference from actual concentration < 0.0015 ppm

Fail = Bias > ±10% AND difference from actual concentration > 0.0015 ppm

Warning = Bias > ±7% AND difference from actual concentration > 0.0015 ppm

Audit concentrations <0.020 ppm are not scored pass/fail, and are informational only

During the assessment, the following PREQB personnel participated:

Guillermo Lopez, Chief Electronics Laboratory
Cesar Rodriguez, Quality Assurance Officer, Ambient Air Monitoring

For the purpose of this audit report, "***Findings***" are defined as factual, objective statements that provide evidence of non-conformance and must be addressed in a corrective action plan. The report also contains "***Suggestions***." These are not findings, but are the opinion of the assessment team offered to further improve the PREQB's Ambient Air Monitoring Program. Where suggestions have been included, a ***"Justification"*** supporting the suggestion is provided. This has been done to highlight some of the benefits that may result from implementation of the suggestion. Finally, ***"Comments***" have been included in the report. These are a partial listing of innovative or exceptional items the assessors wanted to highlight.

IV. AUDIT RESULTS

Through the Probe Field Monitoring Station Audit Results

Through the probe field audits field audits were conducted at the Bayamon-Las Vegas, Salinas, Cataño Police Station, and Bayamon NCore Station Sites. Audit data are included in the attached tables, below.

1. Cataño-Las Vegas Site (SO2), July 12, 2016

Table 1 below, shows the audit results at the Bayamon-Las Vegas site. The site met EPA siting criteria. The SO2 instrument failed EPA audit criteria with a bias >15%. Investigation by EPA revealed that the analyzer line was attached to the

sampling manifold using paraffin film, which was cracked. There was also no ferrule in the manifold connection. This resulted in a leak. (See picture 1, below)

Routing audit gas directly to the back of the analyzer, showed a bias of -10%, which is within EPA criteria. This is consistent with PREQB's calibration checks of the site from the previous week, taken at the back of the analyzer, which showed -9.4% and -8.0% at the span and precision points, respectively. Picture 2 below shows the PREQB calibration check form and results.

The station gas standard for SO2 was plumbed with a brass nut and ferrule, instead of the stainless steel required for reactive gases, and is shown in Picture 3, below. The paraffin film for the SO2 manifold was replaced with Teflon tape by EPA, as a temporary fix (Picture 4).

2. Salinas Site (SO2), July 13, 2016

The Salinas audit results are presented in Table 2 below. The site met siting criteria and EPA audit criteria. Pictures 5 and 6 below, show frayed and worn electrical cords at the site that present a potential fire and electrical shock hazard and should be replaced immediately. EQB staff was notified and shown the hazard at the time of the audit.

3. Cataño Police Station (O3), July 14, 2016

The audit results are presented in Table 3a below. The site met EPA siting criteria. The O3 analyzer met EPA audit criteria at audit level 5 and 4, but failed at Audit Level 3. The cause of the failure is negative zero drift, as can be seen in the -4.1 and -4.2 ppb response to zero air during the audit, as well as the consistent ~4 ppb bias at each audit point.

PREQB calibration checks of July 8 and June 29 showed no zero drift. Calibration checks of June 12 showed a zero bias, pre and post check of -3.7 and -3.9 ppb, respectively (picture 7).

After resetting the zero, (Table 3b, below) EPA introduced a high, low, and zero concentration audit points, and all were within EPA criteria. The results are shown in Table 3b.

4. Bayamon NCore Station (O3, SO2, CO, NOy), July 14, 2016

The monitoring station met EPA siting criteria. The ozone analyzer was the only gaseous instrument audited, and the audit results are presented in Table 4. The instrument met EPA audit criteria.

The SO2, CO, and NOy instruments were known by PREQB to be non-operational prior to our site visit. The following relates the diagnostic trouble shooting done on each instrument:

NOy analyzer: The analyzer was on and responsive to commands, and menus were operational. Low operational PMT voltages were observed during sampling (Picture 8). A PMT diagnostic test was run and failed (picture 9), indicating at least one source of the operational status of the instrument.

SO2 Analyzer: The analyzer was on and responsive to commands, and menus were operational. Analyzer response to zero gas was 99.956 ppb SO2, and to 47.8 ppb audit gas was 848.275 (Pictures 10 and 11). Recalibration of the instrument was not possible, because the instrument zero was too far out of range and locked out by the firmware

CO Analyzer: The analyzer was on and responsive to commands, and menus were operational. A flow warning was flashing on the screen (picture 12). Flow troubleshooting was not attempted.

V. FINDINGS

1. **Finding:** The NOy, SO2, and CO analyzers at the NCore site in Bayamon were not functional. The SO2 and NOy analyzer condition is a repeat finding from our 2015 audits at this site.

   Citation: PREQB participates in the EPA National Performance Audit Program (NPAP) as specified in 40CFR Part 58, Appendix A, Section 2.4, Quality System Requirements. PREQB's SO2 and NOy, SO2, and CO analyzers failed to meet NPAP acceptance criteria.

   Recommended Corrective Action: NOy, SO2 and CO analyzers at the NCore station at Bayamon must be repaired, calibrated, and maintained.

2. **Finding:** The manifold connection in Cataño-Las Vegas used unacceptable materials, and was directly responsible for the failed through the probe audit results.

   Citation: 40CFR Part 58, Appendix E, Section 9(a), specifies that probe materials from the inlet probe to back of the analyzer must be borosilicate glass, FEP Teflon or equivalent.

   Recommended Corrective Action: Replacement of all non-compliant manifold connections at the site, and network-wide.

VI. SUGGESTIONS

Ncore stations are a high priority for the national air monitoring program. Arrangement for EPA Region 2 access to a real time data stream from this site, in order to assist and evaluate system performance, can prevent long term losses of data due to instrument failures or power outages. This is a repeat suggestion from 2015's audit report.

Electrical hazards, such as the frayed power cords seen at Salinas, must be replaced to avoid potential electrical hazards.

VII. COMMENTS

The results of this audit show that PREQB has significant issues in maintaining the NCore station instruments. This is a repeat comment from 2015's audit report.

VII. CONCLUSION

The NCore site, has been neglected with respect to instrument maintenance and calibration.

The use of non-compliant materials in the sample flow path must be eliminated.

PREQB will send a requested corrective action plan to Avraham Teitz and Mustafa Mustafa of the Division of Environmental Science and Assessment's Monitoring and Assessment Branch within 30 days of receipt of this report.

Table 1. Cataño-Las Vegas Site Results (SO2 Analyzer)

EPA Region 2 Audit Report Summary

Site Name: Catano, Las Vegas, Puerto Rico **AIRS Site Code #:** 720330004 **Date:** 7/12/2016

Sulfur Dioxide						
Audit Point	**NPAP Lab Response (ppm)**	**Station Response (ppm)**	**Percent Difference**	**Absolute Difference (ppm)**	**Pass/Fail**	**Warning**
Pre Zero	0.0000	0.0004		0.0004	Pass	
SO2 Audit Point #1	0.0478	0.0395	-17.4	-0.0083	Fail	
SO2 Audit Point #2	0.0190	0.0148	-22.1	-0.0042	Fail	
SO2 Audit Point #3	0.0073	0.0044	-39.7	-0.0029	Fail	
SO2 Audit Point #4	0.0029	0.0021	-27.6	-0.0008	*Informational Only*	
Post Zero	0.0000	0.0000		0.0000	Pass	

Table 2. Salinas Site Results (SO2 Analyzer)

EPA Region 2 Audit Report Summary

Site Name: Salinas, Puerto Rico **AIRS Site Code #:** 721230002 **Date:** 7/13/2016

Sulfur Dioxide						
Audit Point	**NPAP Lab Response (ppm)**	**Station Response (ppm)**	**Percent Difference**	**Absolute Difference (ppm)**	**Pass/Fail**	**Warning**
Pre Zero	0.0000	0.0017		0.0017	Pass	
SO2 Audit Point #1	0.0478	0.0451	-5.6	-0.0027	Pass	
SO2 Audit Point #2	0.0190	0.0174	-8.4	-0.0016	Pass	
SO2 Audit Point #3	0.0073	0.0078	6.8	0.0005	Pass	
SO2 Audit Point #4	0.0029	0.0049	69.0	0.0020	*Informational Only*	
Post Zero	0.0000	0.0030		0.0030	Pass	

Table 3a. Cataño Police Station (O3 Analyzer)

EPA Region 2 Audit Report Summary

Site Name: Catano Police Station, Puerto Rico **AIRS Site Code #:** 720330008 **Date:** 7/14/2016

Ozone						
Parameter	**NPAP Lab Response (ppm)**	**Station Response (ppm)**	**Percent Difference**	**Absolute Difference (ppm)**	**Pass/Fail**	**Warning**
Pre Zero	0.0006	-0.0042		-0.0048	Pass	
Ozone Audit Point #1	0.1008	0.0961	-4.7	-0.0047	Pass	
Ozone Audit Point #2	0.0804	0.0754	-6.2	-0.0050	Pass	
Ozone Audit Point #3	0.0530	0.0488	-7.9	-0.0042	Pass	Warning
Ozone Audit Point #4	0.0340	0.0292	-14.1	-0.0048	Fail	
Ozone Audit Point #5	0.0183	0.0138	-24.6	-0.0045	*Informational Only*	
Post Zero	0.0005	-0.0041		-0.0046	Pass	

Table 3b. Cataño Police Station after zero correction (O3 Analyzer)

EPA Region 2 Audit Report Summary

Site Name: Catano Police Station, Puerto Rico **AIRS Site Code #:** 720330008 **Date:** 7/14/2016

Ozone						
Parameter	**NPAP Lab Response**	**Station Response (ppm)**	**Percent Difference**	**Absolute Difference**	**Pass/Fail**	**Warning**
Pre Zero	0.0002	0.0003		0.0001	Pass	
Ozone Audit Point #1	0.0830	0.0834	0.5	0.0004	Pass	
Ozone Audit Point #2	0.0185	0.0183	-1.1	-0.0002	*Informational Only*	
Post Zero	0.0003	0.0001		-0.0002	Pass	

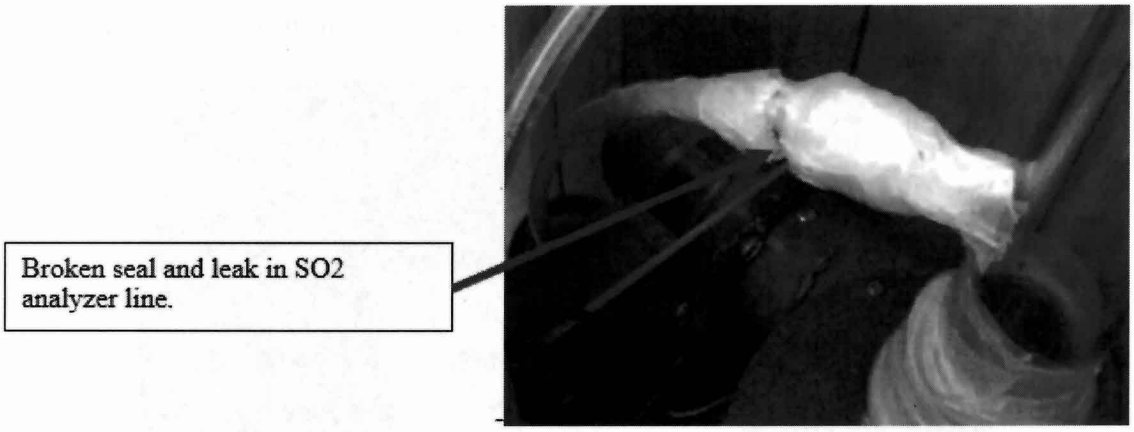
Table 4. Bayamon Jail – Ncore Station Results (O3 Analyzer)

EPA Region 2 Audit Report Summary

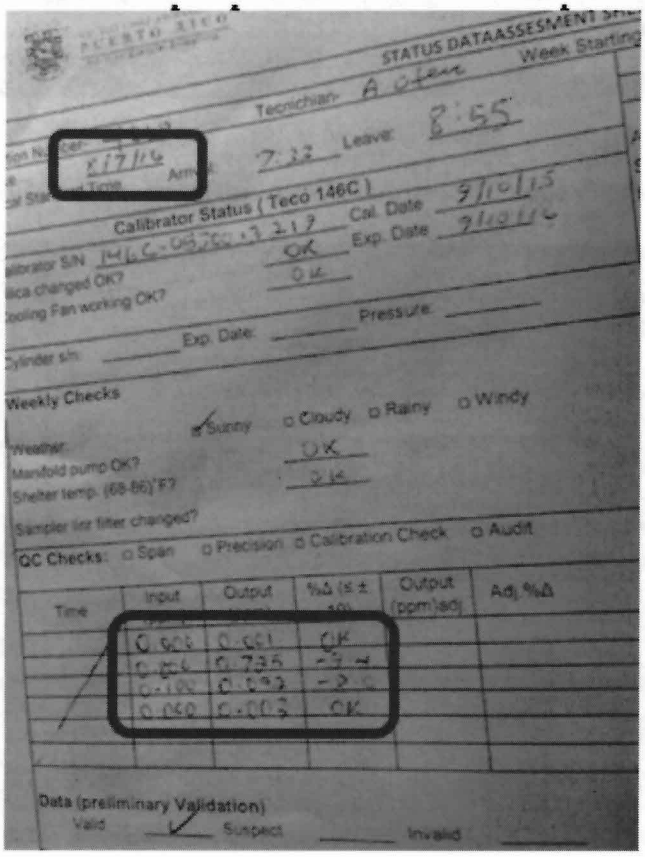
Site Name: Bayamon Ncore Station, Puerto Rico **AIRS Site Code #:** 720210010 **Date:** 7/14/2016

Ozone						
Parameter	**NPAP Lab Response (ppm)**	**Station Response (ppm)**	**Percent Difference**	**Absolute Difference (ppm)**	**Pass/Fail**	**Warning**
Pre Zero	0.0007	-0.0009		-0.0016	Pass	
Ozone Audit Point #1	0.0866	0.0816	-5.8	-0.0050	Pass	
Ozone Audit Point #2	0.0598	0.0565	-5.5	-0.0033	Pass	
Ozone Audit Point #3	0.0378	0.0356	-5.8	-0.0022	Pass	
Ozone Audit Point #4	0.0185	0.0170	-8.1	-0.0015	*Informational Only*	
Post Zero	0.0004	0.0002		-0.0002	Pass	

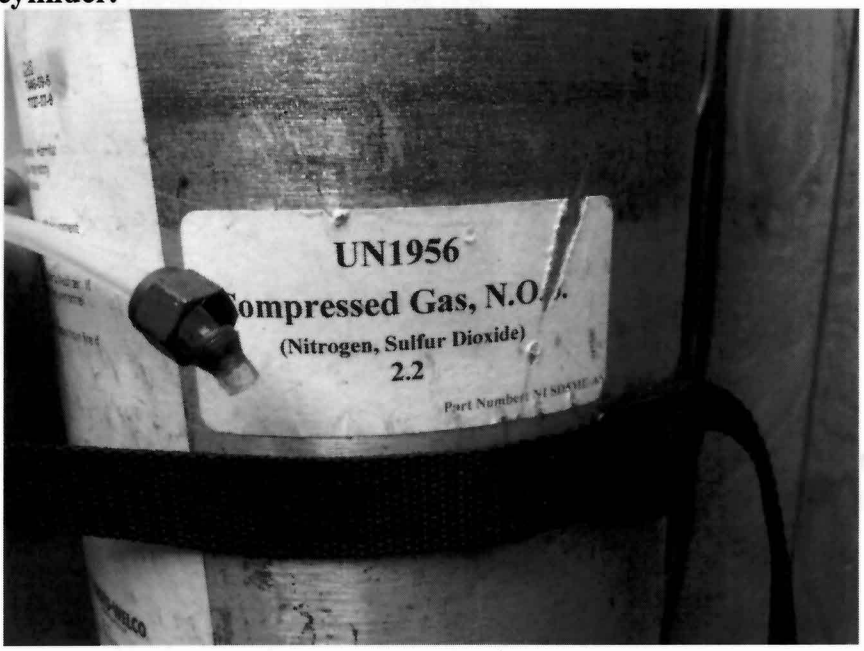
Picture 1. Cataño-Las Vegas Site, showing parafilm for sealing analyzer to manifold.



Picture 2. PREQB span and precision check @ Cataño-Las Vegas site from July 8, 2016 showing -9.4% bias at span point and -8.0% bias at precision point.

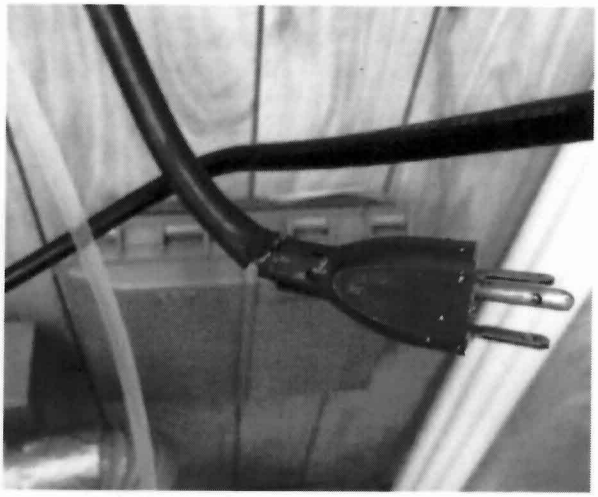


Picture 3. Cataño-Las Vegas Site, showing brass ferrules and nuts in use with NOx standards cylinder.

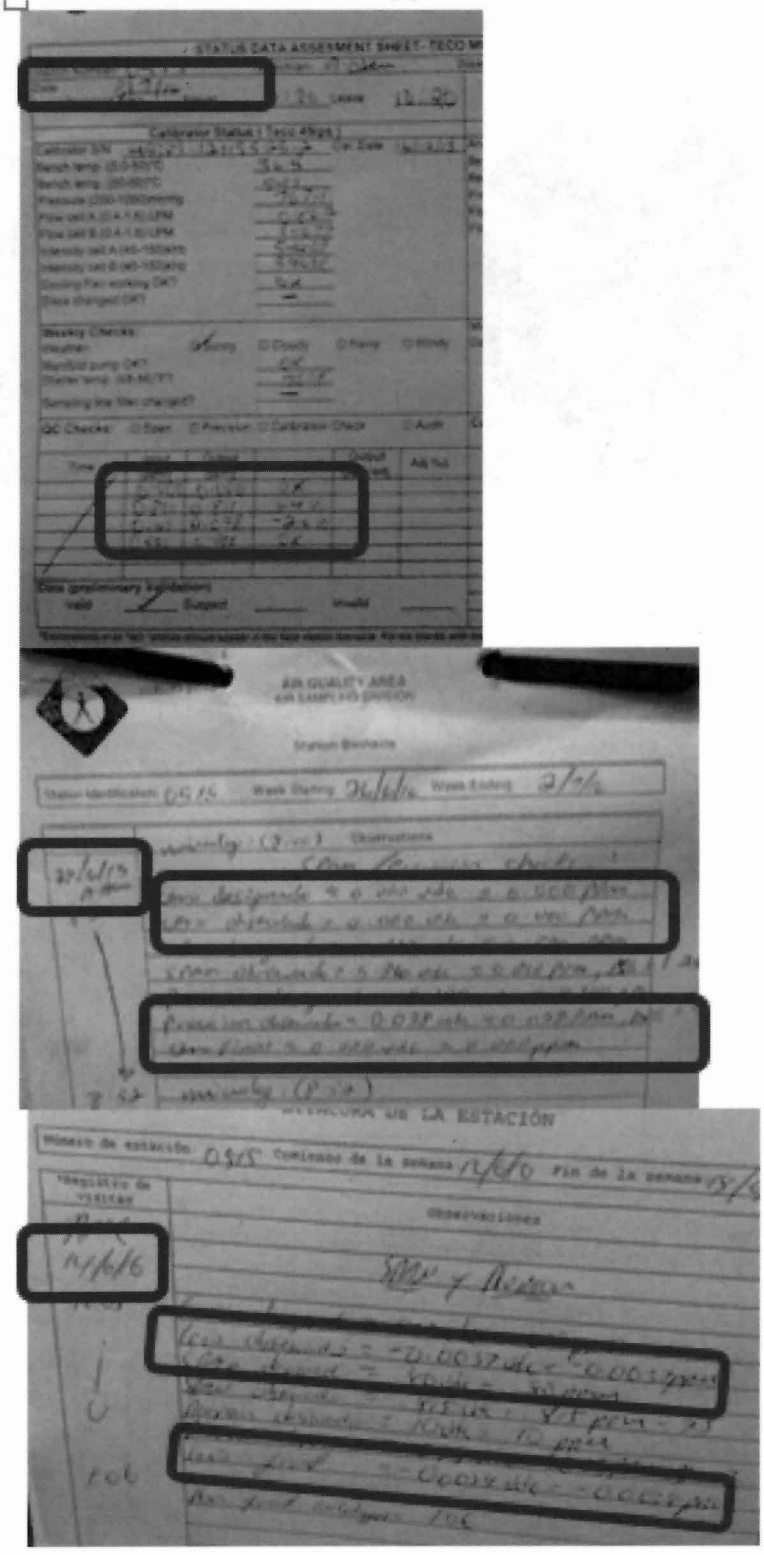


Picture 4. Cataño-Las Vegas Site, showing replacement of parafilm with Teflon tape

Picture 5 and 6 – Electrical hazards at Salinas site.

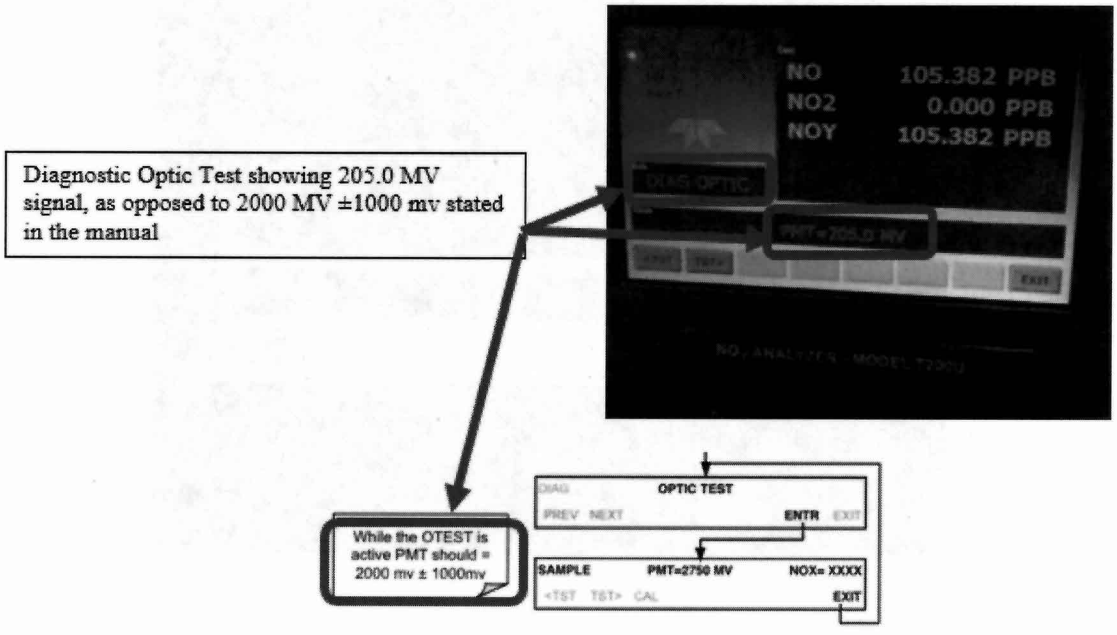


Picture 7. Cataño Police Station Site – Showing no zero drift @ July 8 and June 29th calibration checks. A drift of -3.7 and -3.9 ppb were observed on June 12th.



Picture 8. Bayamon NCore Station - NOy Analyzer PMT value while sampling.

Picture 9. Bayamon NCore Station - NOy Analyzer PMT value and expectations from analyzer manual



Note **This is a coarse test for functionality and not an accurate calibration tool. The resulting PMT signal can vary significantly over time and also changes with low-level calibration.**

Picture 10 and 11. Bayamon NCore Station - SO2 analyzer response to EPA zero gas, and 47.8 ppb SO2

Picture 12. Bayamon NCore Station – CO Analyzer Flow Warning